Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously Presented) A method of processing n-dimensional digital signals, n being an integer at least equal to 1, comprising the steps of:

(a) receiving an *n*-dimensional digital input signal;

(b) computing an *n*-dimensional warped signal from said *n*-dimensional digital input signal, the *n*-dimensional warped signal including *n*-dimensional warped coefficients and *n*-dimensional signal warping grids; and

(c) computing warped wavelet packet coefficients and wavelet packet warping grids by applying an *n*-dimensional warped wavelet packet transform to said warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$.

2-7. (Canceled)

8. (Currently Amended) A signal processing method according to claim 1, wherein said signal warping grids are computed from a warping geometry defined by region parameters specifying a partition of a signal support into a plurality of regions and deformation parameters specifying geometrical deformation functions respectively associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions.

9-10. (Canceled)

11. (Previously Presented) A signal processing method according to claim 8, wherein $n=3$,

the n-dimensional digital input signal representing a video image sequence, and wherein the step of computing the n-dimensional warped signal comprises:

(a) estimating motion vectors within said video image sequence;

(b) determining at least one of said n-dimensional geometrical deformation functions by applying a time displacement to a 2-dimensional geometrical deformation using said estimated motion vectors; and

(c) computing said n-dimensional warped signal from said warping geometry and the received n-dimensional digital input signal.

12. (Previously Presented) A signal processing method according to claim 8, further comprising the step of applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids.

13-16. (Canceled)

17. (Previously Presented) A signal processing method according to claim 12, further comprising the steps of:

(a) quantizing said bandelet coefficients to produce quantized bandelet coefficients; and

(b) encoding said quantized bandelet coefficients and said region and deformation parameters into a multiplexed data stream suitable for storage in a storage medium or for transmission over a transmission medium said multiplexed data stream being a compressed representation of an n-dimensional input signal from which the n-dimensional warped signal is computed.

18-25. (Canceled)

26. (Previously Presented) A signal processing method according to claim 17, wherein n=3

and said *n*-dimensional digital input signal represents a video image sequence, and wherein the step of computing the parameters defining the warping geometry comprises:

(a) estimating motion vectors within said video image sequence; and

(b) determining at least one of said *n*-dimensional geometrical deformation functions by applying a time displacement to a 2-dimensional geometrical deformation using said estimated motion vectors.

27-37. (Canceled)

38. (Original) A method of processing n-dimensional digital signals, n being an integer at least equal to 1, comprising the steps of:

(a) providing warped wavelet packet coefficients and wavelet packet warping grids; and

(b) computing a warped signal including *n*-dimensional warped coefficients and *n*-dimensional signal warping grids based on said warped wavelet packet coefficients and wavelet packet warping grids, with a binary tree where each node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(c) applying an inverse warping operation to said warped signal to produce an output signal.

39-43. (Canceled)

44. (Previously Presented) A signal processing method according to claim 38, wherein the step of providing the warped wavelet packet coefficients and wavelet packet warping grids comprises:

(a) obtaining bandelet coefficients;

(b) obtaining parameters defining a warping geometry;

(c) computing said wavelet packet warping grids from said warping geometry; and

(d) computing said warped wavelet packet coefficients by applying an inverse bandeletisation to said bandelet coefficients, wherein said inverse bandeletisation comprises computing warped wavelet packet coefficients by applying inverse one-dimensional

decorrelation operators to said bandelet coefficients, along selected directions of said wavelet packet warping grids.

45-48. (Canceled)

49. (Original) A signal decompression method, comprising the steps of:

(a) receiving a multiplexed data stream representing a compressed n-dimensional digital signal from a transmission or storage medium, n being an integer at least equal to 1;

(b) decoding the received multiplexed data stream to obtain quantized bandelet coefficients and parameters defining a warping geometry;

(c) computing wavelet packet warping grids from said warping geometry;

(d) computing warped wavelet packet coefficients by applying an inverse bandeletisation to said quantized bandelet coefficients, wherein said inverse bandeletisation comprises computing warped wavelet packet coefficients by applying inverse one-dimensional decorrelation operators to said quantized bandelet coefficients along selected directions of said wavelet packet warping grids;

(e) computing a warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids based on said warped wavelet packet coefficients and wavelet packet warping grids, with a binary tree where each node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(f) applying an inverse warping operation to said warped signal to produce a decompressed version of said n-dimensional digital signal.

50-58. (Canceled)

59. (Withdrawn) A signal restoration method, comprising the steps of:

(a) receiving an n-dimensional digital input signal, n being an integer at least equal to 1;

(b) providing region and deformation parameters defining a warping geometry, wherein the region parameters specify a partition of an n-dimensional signal support into a plurality of regions and the deformation parameters specify geometrical deformation functions respectively

associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions;

(c) computing an n-dimensional warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids from said warping geometry and the received n-dimensional digital input signal;

(d) computing warped wavelet packet coefficients and wavelet packet warping grids by applying an n-dimensional warped wavelet packet transform to said warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$;

(e) applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids;

(f) applying a restoration process to said bandelet coefficients and said warping geometry to provide processed bandelet coefficients and processed warping geometry;

(g) computing processed wavelet packet warping grids from said processed warping geometry;

(h) computing processed warped wavelet packet coefficients by applying an inverse bandeletisation to said processed bandelet coefficients, wherein said inverse bandeletisation comprises computing processed warped wavelet packet coefficients by applying inverse one-dimensional decorrelation operators to said processed bandelet coefficients, along selected directions of said processed wavelet packet warping grids;

(i) computing a processed warped signal including n-dimensional processed warped coefficients and n-dimensional processed signal warping grids based on said processed warped wavelet packet coefficients and processed wavelet packet warping grids, with a binary tree where each node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(j) applying an inverse warping operation to said warped signal to produce a restored n-dimensional digital output signal.

60. (Withdrawn) A signal restoration method according to claim 59 wherein said restoration process comprises applying a thresholding operator to said bandelet coefficients.

61-68. (Canceled)

69. (Withdrawn) A signal restoration method claim 59, wherein n=3 and the received n-dimensional digital input signal represents a video image sequence, and wherein the step of providing the parameters defining the warping geometry comprises:

(a) estimating motion vectors within said video image sequence; and

(b) determining at least one of said n-dimensional geometrical deformation functions by applying a time displacement to a 2-dimensional geometrical deformation using said estimated motion vectors.

70-71. (Canceled)

72. (Previously Presented) A digital signal encoder to compress n-dimensional digital signals, n being an integer at least equal to 1, comprising:

(a) a geometrical segmentation and sampling section for receiving an n-dimensional digital input signal and for providing region and deformation parameters defining a warping geometry, wherein the region parameters specify a partition of an n-dimensional signal support into a plurality of regions and the deformation parameters are quantized and specify geometrical deformation functions respectively associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions;

(b) a signal warping unit for computing an n-dimensional warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids from said warping geometry and the received n-dimensional digital input signal;

(c) a warped wavelet packet processor for computing warped wavelet packet coefficients and wavelet packet warping grids by applying an n-dimensional warped wavelet packet

transform to said warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$;

(d) a bandeletisation unit for applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids;

(e) a quantizer for quantizing said bandelet coefficients to produce quantized bandelet coefficients; and

(f) an encoder for encoding said quantized bandelet coefficients and said region and deformation parameters into a multiplexed data stream suitable for storage in a storage medium or for transmission over a transmission medium.

73. (Previously Presented) A digital signal decoder to decompress n-dimensional digital signals, n being an integer at least equal to 1, comprising:

(a) a decoder for receiving a multiplexed data stream representing a compressed n-dimensional digital signal from a transmission or storage medium and for decoding the received multiplexed data stream to obtain quantized bandelet coefficients and parameters defining a warping geometry;

(b) a geometrical sampling unit for computing wavelet packet warping grids from said warping geometry;

(c) an inverse bandeletisation unit for computing warped wavelet packet coefficients by applying an inverse bandeletisation to said quantized bandelet coefficients, wherein said inverse bandeletisation comprises computing warped wavelet packet coefficients by applying inverse one-dimensional decorrelation operators to said quantized bandelet coefficients along selected directions of said wavelet packet warping grids;

(d) an inverse warped wavelet packet processor for computing a warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids based on said warped wavelet packet coefficients and wavelet packet warping grids, with a binary tree where each

node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(e) an inverse warping unit for applying an inverse warping operation to said warped signal to produce a decompressed version of said n-dimensional digital signal.

74-75. (Canceled)

76. (Withdrawn) A digital signal restoration system, comprising:

(a) means for receiving an n-dimensional digital input signal, n being an integer at least equal to 1,

(b) means for providing region and deformation parameters defining a warping geometry, wherein the region parameters specify a partition of an n-dimensional signal support into a plurality of regions and the deformation parameters specify geometrical deformation functions respectively associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions;

(c) means for computing an n-dimensional warned signal including n-dimensional warped coefficients and n-dimensional signal warping grids from said warping geometry and the received n-dimensional digital input signal;

(d) means for computing warped wavelet packet coefficients and wavelet packet warping grids by applying an n-dimensional warped wavelet packet transform to said warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$;

(e) means for applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids:

(f) means for applying a restoration process to said bandelet coefficients and said warping geometry to provide processed bandelet coefficients and processed warping geometry,

(g) means for computing processed wavelet packet warping grids from said processed warping geometry;

(h) means for computing processed warped wavelet packet coefficients by applying an inverse bandeletisation to said processed bandelet coefficients, wherein said inverse bandeletisation comprises computing processed warped wavelet packet coefficients by applying inverse one-dimensional decor-relation operators to said processed bandelet coefficients, along selected directions of said processed wavelet packet warning grids;

(i) means for computing a processed warped signal including n-dimensional processed warped coefficients and n-dimensional processed signal warping grids based on said processed warped wavelet packet coefficients and processed wavelet packet warping grids, with a binary tree where each node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(j) means for applying an inverse warping operation to said warped signal to produce a restored n-dimensional digital output signal.

77. (Previously Presented) A computer program product for compressing n-dimensional digital signals in a computer system, comprising:

(a) code instructions for receiving an n-dimensional digital input signal, n being an integer at least equal to 1;

(b) code instructions for providing region and deformation parameters defining a warping geometry, wherein the region parameters specify a partition of an n-dimensional signal support into a plurality of regions and the deformation parameters are quantized and specify geometrical deformation functions respectively associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions;

(c) code instructions for computing an n-dimensional warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids from said warping geometry and the received n-dimensional digital input signal;

(d) code instructions for computing warped wavelet packet coefficients and wavelet packet warping grids by applying an n-dimensional warped wavelet packet transform to said

warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$;

(e) code instructions for applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids;

(f) code instructions for quantizing said bandelet coefficients to produce quantized bandelet coefficients; and

(g) code instructions for encoding said quantized bandelet coefficients and said region and deformation parameters into a multiplexed data stream suitable for storage in a storage medium or for transmission over a transmission medium.

78. (Previously Presented) A computer program product for decompressing n-dimensional digital signals in a computer system, comprising:

(a) code instructions for receiving a multiplexed data stream representing a compressed n-dimensional digital signal from a transmission or storage medium, n being an integer at least equal to 1;

(b) code instructions for decoding the received multiplexed data stream to obtain quantized bandelet coefficients and parameters defining a warping geometry;

(c) code instructions for computing wavelet packet warping grids from said warping geometry;

(d) code instructions for computing warped wavelet packet coefficients by applying an inverse bandeletisation to said quantized bandelet coefficients, wherein said inverse bandeletisation comprises computing warped wavelet packet coefficients by applying inverse one-dimensional decorrelation operators to said quantized bandelet coefficients along selected directions of said wavelet packet warping grids;

(e) code instructions for computing a warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids based on said warped wavelet packet coefficients and wavelet packet warping grids, with a binary tree where each node performs a

one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(f) code instructions for applying an inverse warping operation to said warped signal to produce a decompressed version of said n-dimensional digital signal.

79. (Withdrawn) A computer program product for restoring n-dimensional digital signals in a computer system, comprising:

(a) code instructions for receiving an n-dimensional digital input signal, n being an integer at least equal to 1;

(b) code instructions for providing region and deformation parameters defining a warping geometry, wherein the region parameters specify a partition of an n-dimensional signal support into a plurality of regions and the deformation parameters specify geometrical deformation functions respectively associated with said regions, whereby the geometrical deformation function associated with one of the regions provides positions of sampling points within said one of the regions;

(c) code instructions for computing an n-dimensional warped signal including n-dimensional warped coefficients and n-dimensional signal warping grids from said warping geometry and the received n-dimensional digital input signal;

(d) code instructions for computing warped wavelet packet coefficients and wavelet packet warping grids by applying an n-dimensional warped wavelet packet transform to said warped signal, with a binary tree where each node performs a one-dimensional warped subband processing along a respective dimension d, with $1 \leq d \leq n$;

(e) code instructions for applying a bandeletisation to said warped wavelet packet coefficients and wavelet packet warping grids, wherein said bandeletisation comprises computing bandelet coefficients by applying invertible one-dimensional decorrelation operators to said warped wavelet packet coefficients along selected directions of said wavelet packet warping grids;

(f) code instructions for applying a restoration process to said bandelet coefficients and said warping geometry to provide processed bandelet coefficients and processed warping geometry;

(g) code instructions for computing processed wavelet packet warping grids from said processed warping geometry;

(h) code instructions for computing processed warped wavelet packet coefficients by applying an inverse bandeletisation to said processed bandelet coefficients, wherein said inverse bandeletisation comprises computing processed warped wavelet packet coefficients by applying inverse one-dimensional decor-relation operators to said processed bandelet coefficients, along selected directions of said processed wavelet packet warping grids;

(i) code instructions for computing a processed warped signal including n-dimensional processed warped coefficients and n-dimensional processed signal warping grids based on said processed warped wavelet packet coefficients and processed wavelet packet warping grids, with a binary tree where each node performs a one-dimensional inverse warped subband processing along a particular dimension d, with $1 \leq d \leq n$; and

(j) code instructions for applying an inverse warping operation to said warped signal to produce a restored n-dimensional digital output signal.

80. (New) A signal processing method according to claim 1, wherein the step of computing an *n*-dimensional warped signal includes computing an *n*-dimensional warped signal from said *n*-dimensional digital input signal, the *n*-dimensional warped signal including *n*-dimensional warped coefficients and *n*-dimensional signal warping grids from which the *n*-dimensional digital input signal can be reconstructed without any residual.